Coronectomy

Indications, Outcomes, and Description of Technique

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KEYWORDS

• Coronectomy • Third molars • Inferior alveolar nerve

KEY POINTS

- Coronectomy is considered a reasonable and safe treatment alternative for patients who demonstrate elevated risk for injury to the inferior alveolar nerve with the removal of third molars.
- The procedure has been documented in the oral and maxillofacial surgery literature as a treatment alternative to extraction of third molar in patients considered at elevated risk for permanent nerve injury.
- Coronectomy is particularly appropriate for patients who are older than 25 years and who report low tolerance for the possibility of posttreatment neurosensory deficit at the consultation.
- Appropriate patient selection for coronectomy is paramount.
- Periodic follow-up assessments are required, and patient compliance is essential.

Coronectomy was first described by Ecuyer and Debien in 1984 as an alternative procedure to traditional extraction of third molars.[1] Several reports have been published since regarding the technique, indications, efficacy, and outcome of this procedure. Most recently, it has been investigated as an alternative to traditional surgical extraction of third molars, particularly for those with an increased risk of damage to the inferior alveolar nerve (IAN). Several studies have demonstrated that coronectomy does significantly decrease the risk of iatrogenic injury to the IAN, with some studies also suggesting a lower complication rate. This article discusses the indications for coronectomy, the author's technique, and the complications and outcomes of this procedure.

Indications

The main indication for performing a coronectomy is to prevent iatrogenic injury to the IAN when removing a third molar. Therefore, the ability to determine whether the IAN is at high risk is paramount and should be well understood.

The frequency of IAN damage after extraction of a third molar ranges anywhere from 0.4% to 8.4%.[2–5] Panoramic radiographs are traditionally used in the preoperative evaluation of patients who will undergo surgical extraction of mandibular teeth. Increasingly, computed tomography scanning is used to evaluate the relationship of the tooth to the IAN in 3 dimensions, but is not yet the standard of care, owing to cost and the increased exposure of the patient to radiation. Certain radiographic features that depict an increased risk of iatrogenic IAN damage when extracting third molars include darkening of the root, narrowing of the apices, deflection of the root, diversion of the IAN canal, narrowing of the IAN canal, and interruption of the white line of the IAN canal.[2,6] Coronectomy may decrease the incidence of damage to the IAN in these cases of increased risk.

Pogrel and colleagues[7] performed 50 coronectomies on 41 patients who were at significantly increased risk of IAN damage from panoramic radiographic assessment, and found no postoperative cases of inferior alveolar nerve involvement. Similar results were reported by Leung and Cheung,[8] who performed 171 coronectomies and 178 surgical extractions (controls) of third molars on 231 patients. Nine patients in the control group presented with IAN sensory deficit versus 1 patient in the coronectomy group, demonstrating a statistically significant decrease in IAN damage using coronectomy for high-risk patients.[8]

Contraindications

The success of coronectomy depends on the survival of the retained root fragments with the successful formation of osteocementum and bone over the roots. Any tooth with active caries into the pulp, or demonstrating periapical abnormality should not be considered for coronectomy. Horizontally impacted teeth and teeth associated with tumors or large cysts should be excluded. The coronectomy procedure can otherwise be accomplished with vertically positioned, mesially tilted, and distally angulated teeth. Other local factors excluding coronectomy are patients scheduled for an osteotomy in the future. Patients excluded for systemic reasons from undergoing coronectomy include immunocompromised patients (chemotherapy, AIDS, radiation therapy, immunomodulating drug

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therapy, and so forth), poorly controlled diabetics, and those patients who are to undergo radiation therapy.[7–9]

Technique

The technique used by the authors and described here is similar to that described in the literature, for example by Pogrel and colleagues.[7]

1. First the patients are evaluated radiographically for root proximity to the IAN. If the patient is at significant increased risk for damage to the IAN, the option of coronectomy is discussed as an alternative to third-molar extraction. Criteria for selection involves the degree of root development, the degree of associated abnormality, the age of the patient, and patient tolerance for the potential of sustaining permanent neurosensory disturbance (Fig. 1A–D).
2. Once coronectomy has been decided upon for treatment, informed consent is obtained. Included in the consent process is a thorough discussion of the rationale for coronectomy. Risks including, but not limited to, infection, neurosensory disturbance, coronal migration of retained root fragments requiring surgical retrieval, and the potential need for additional surgical procedures are discussed. The possibility that extraction of the tooth may be necessary in the event of extensive decay, active infection, and mobility of retained roots is also included in the consent process.
3. IAN blocks including long buccal infiltration are accomplished with 2% lidocaine with 1:100,000 epinephrine and 0.5% bupivacaine with 1:100,000 epinephrine. A full-thickness mucoperiosteal incision is elevated with posterior buccal release. If necessary, a conservative buccal trough is made using a #6 round carbide bur on a nitrogen-driven surgical hand piece, allowing access to the cementoenamel junction of the tooth. Care is exercised to maintain as much crestal bone height as possible by minimizing the width of the buccal trough. After exposure is obtained, a 701 fissure bur is used and a horizontal/transverse cut is made through the tooth at the level of the cementoenamel junction. Visualization is important to ensure adequate sectioning of the crown without perforation through the lingual bone plate. The crown is delicately fractured and separated from the residual roots of the tooth using a straight elevator. Effort is directed at minimizing any mobilization of the residual roots. On removal of the crown, any sharp fragments of retained tooth structure are smoothed down with a 2.3-mm diameter diamond round bur with simultaneous copious saline irrigation. The remaining enamel is typically reduced approximately 3 mm below the buccal crest of alveolar bone (Fig. 2A–J).
    a. Root canal treatment is not indicated during coronectomy. Sencimen and colleagues[10] found that patients having coronectomy with root canal treatment had a much higher infection rate than those patients who underwent coronectomy without root canal treatment. Seven of the 8 patients undergoing root canal treatment developed postoperative infections, whereas only 1 of 8 patients in the control group developed an infection. The investigators suggested that mobilization of the root during root canal therapy and/or prolonged procedure time may contribute to the higher infection rate in the study group.
4. After the coronectomy is completed, a dental curette is used for removal of any and all follicular soft tissue in the surgical bony defect. Any grossly visible exposed pulpal soft tissue is curetted. A bone file is used to smooth the bone edges along the socket defect and buccal bone trough. The incision is copiously irrigated with saline, and a small amount of doxycycline powder (doxycycline hyclate, 50 mg capsules; Watson Laboratories, Corona, CA) is applied topically to the surgical site before closure with chromic suture. Primary closure is desirable whenever possible, and may involve making a releasing incision distal to the second molar to facilitate closure. An immediate postoperative panoramic radiograph is obtained for a baseline assessment of the retained root fragment (Fig. 3A–F).
5. Postoperatively, patients are placed on a 1-week course of antibiotic therapy. Typically penicillin VK, 500 mg by mouth 4 times daily or clindamycin 300 mg by mouth 3 times daily (in penicillin allergic patients) is used. Chlorhexidine gluconate oral rinse 0.12% 3 times daily for 10 days is prescribed postoperatively. Analgesia is accomplished with hydrocodone/acetaminophen and nonsteroidal anti-inflammatories, as in patients who have had a third molar extracted. Patients are scheduled for a follow-up visit at approximately 10 days after surgery, and are given an

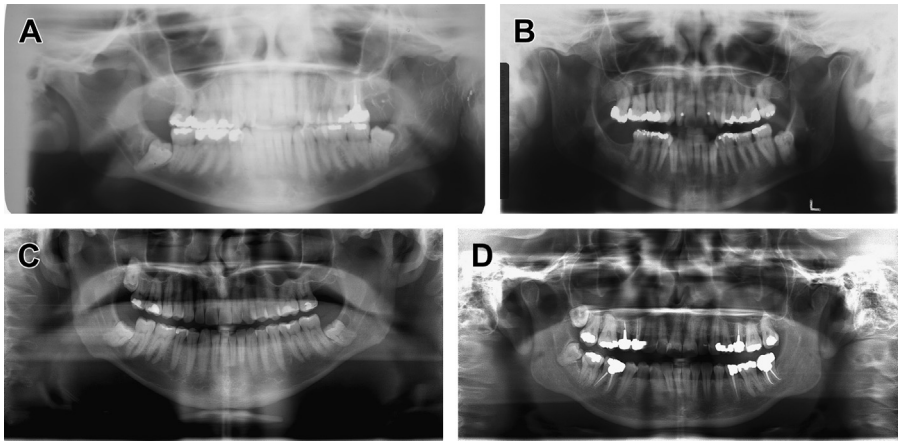

Fig. 1 Patients noted to be at elevated risk for injury to the inferior alveolar nerve. (*A*) A 41-year-old woman presenting with pericoronitis, teeth #17 and #32. (*B*) A 69-year-old woman presenting with pericoronitis and caries, tooth #17. (*C*) A 41-year-old man presenting with pericoronitis, tooth #17. (*D*) A 41-year-old woman presenting with pericoronitis and infection, tooth #32.

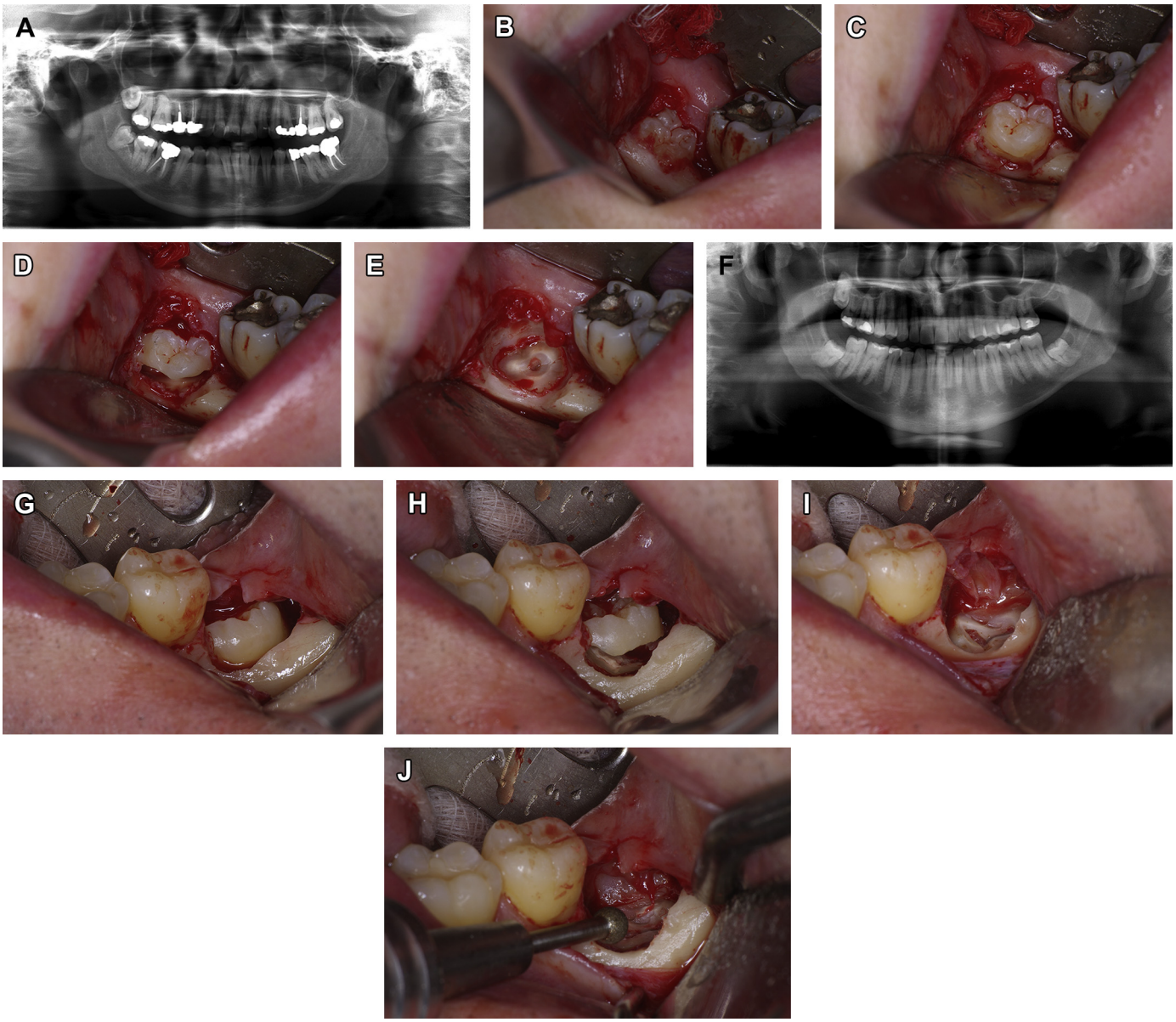

Fig. 2 Photographic documentation of the coronectomy procedure using the author's technique, involving 2 patients. Patient I.P. is a 41-year-old woman who presented with pericoronitis and infection associated with impacted tooth #32. Patient H.N. is a 41-year-old man who presented with pericoronitis associated with tooth #17. (*A*) Patient I.P.: pretreatment panoramic radiograph (also seen in Fig. 1D). (*B*) Patient I.P.: surgical exposure of tooth #32. (*C*) Patient I.P.: trough formation with #6 round bur. (*D*) Patient I.P.: horizontal cut made with 701 tapered fissure bur. (*E*) Patient I.P.: after removal of crown of tooth #32. (*F*) Patient H.N.: pretreatment panoramic radiograph (also seen in Fig. 1C). (*G*) Patient H.N.: trough formation around tooth #17 with #6 round bur. (*H*) Patient H.N.: horizontal cut made with 701 tapered fissure bur. (*I*) Patient H.N.: after removal of crown, tooth #17. (*J*) Patient H.N.: residual roots smoothed with a 2.3-mm diameter diamond round bur.

irrigation syringe for cleansing of the surgical site at that time. Patients are instructed to return for reevaluation at 6 months postoperatively. A periodontal assessment and panoramic radiograph is obtained at the 6-month post-treatment visit. In the author's practice, an immediate posttreatment panoramic radiograph is obtained for baseline assessment, and a subsequent panoramic radiograph or periapical radiograph is obtained at 6 months posttreatment to assess for coronal migration of roots, potential abscess formation, bone formation over the residual root fragments, and overall healing. It is the author's opinion that this radiographic protocol is warranted given the reduced incidence of permanent neurosensory disturbance in these patients (Figs. 4–7).

Complications

Complications after coronectomy are similar to those of traditional third-molar surgery, which are well known to oral and maxillofacial surgeons: bleeding, infection, pain, IAN damage, alveolar osteitis, and poor healing. Complications unique to coronectomy include mobilization of the roots during the procedure and postoperative migration of the roots.

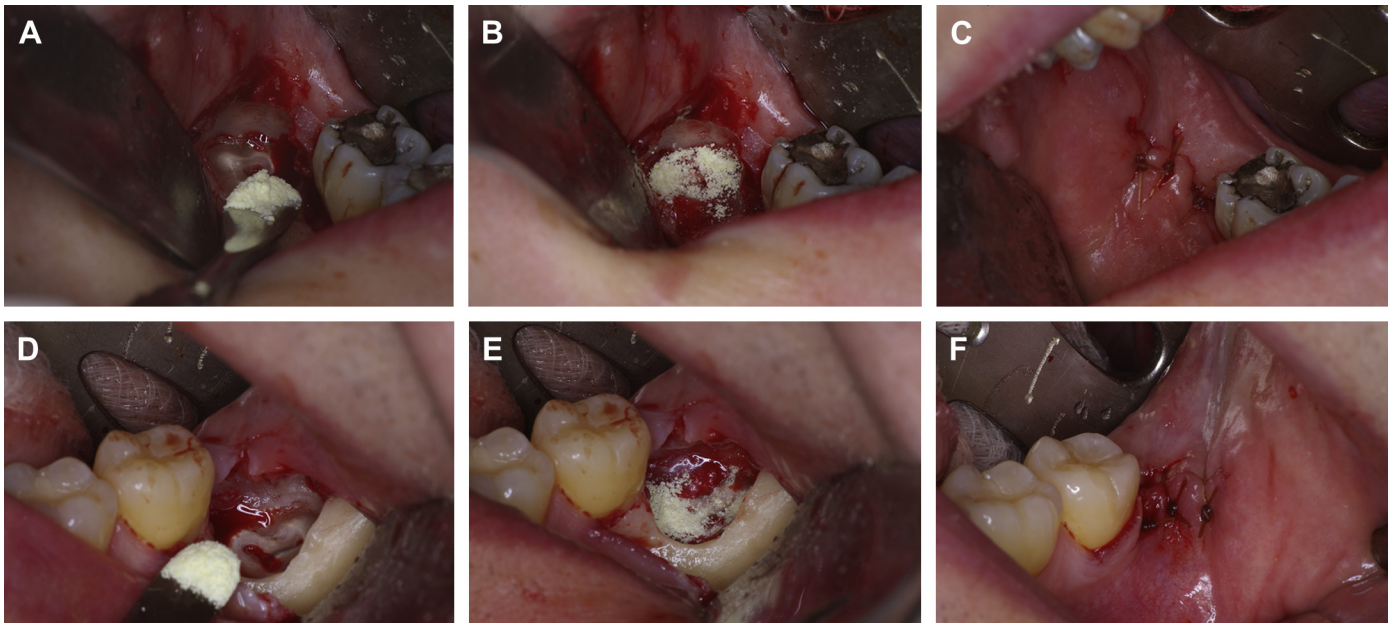

Fig. 3 Completion of coronectomy procedures using the authors' technique on patients I.P. and H.N. (*A*) Patient I.P.: doxycycline powder is applied topically to residual root with #9 periosteal elevator. (*B*) Patient I.P.: doxycycline powder in surgical site. (*C*) Patient I.P.: primary closure of surgical site with 3-0 chromic suture. (*D*) Patient H.N.: doxycycline powder applied topically to residual root with #9 periosteal elevator. (*E*) Patient H.N.: doxycycline powder in surgical site. (*F*) Patient H.N.: primary closure of surgical site with 3-0 chromic suture.

Postoperative discomfort does not appear to be different to that with traditional third-molar extraction, with some investigators reporting less discomfort with coronectomy.[11–13] The incidence of alveolar osteitis is similar with coronectomy, reported in the range of 10% to 12%.[13] Delayed healing typically occurs for 1 of 2 reasons: mobilization of the root fragments during coronectomy or retention of enamel during the procedure.[11] These patients require an additional procedure to remove the root fragment or retained enamel. Infection rates are reported as between 1% and 5.2%, which is similar to the incidence after extraction of third molars.[11–13]

The most common perioperative complication when performing coronectomy is mobilization of the root fragment.[7,11,12] Patients at higher risk are females and those with teeth with conical root formation.[12] Mobilization of the roots will also occur when significant force is applied when fracturing the crown of the tooth during the procedure. If inadvertent mobilization of the roots is noted perioperatively, the mobile root fragments must be removed to prevent a foreign-body reaction and poor healing. The most commonly reported long-term consequence of coronectomy is coronal migration of the roots.[7,11–13] Migration seems to always be in a coronal direction, with 14% to 81% of roots migrating on average 2 to 4 mm.[7,8,11–13] Although long-term follow-up studies are still needed, the coronal movement of roots seems to occur predominantly during the first 6 months postoperatively and slows down thereafter.

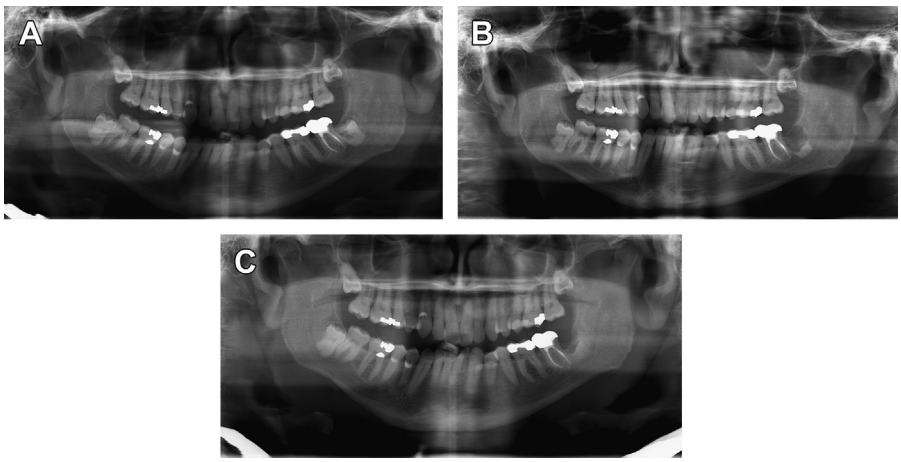

Fig. 4 Patient W.B. is a 62-year-old man with a history of pain, pericoronitis, and caries associated with tooth #17. He was planned for coronectomy on tooth #17. (*A*) Preoperative panoramic radiograph. (*B*) Immediate postoperative panoramic radiograph. (*C*) Panoramic radiograph obtained 8 months postoperatively.

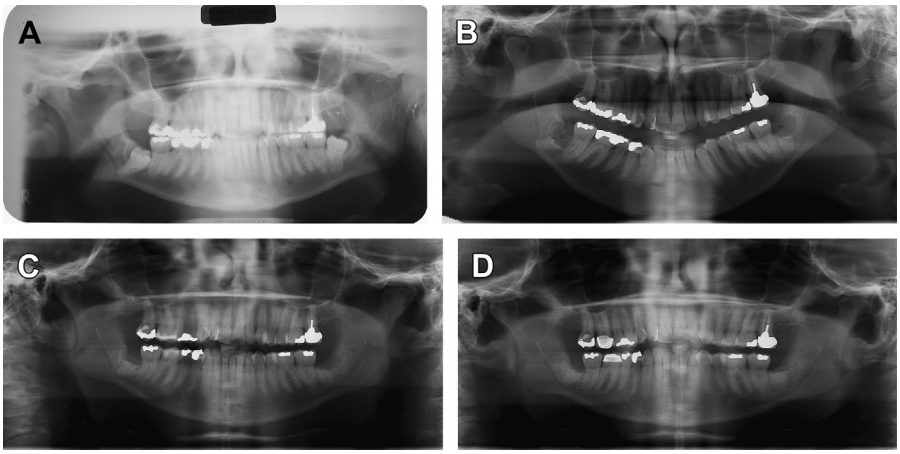

Fig. 5 Patient K.N. is a 41-year-old woman who presented with pericoronitis associated with teeth #17 and #32. She was planned for coronectomies on both teeth. (*A*) Preoperative panoramic radiograph (also seen in Fig. 1A). (*B*) Immediate postoperative panoramic radiograph. (*C*) Panoramic radiograph obtained 6 months postoperatively. (*D*) Panoramic radiograph obtained 27 months postoperatively. Note coronal migration of residual roots away from radiographic inferior alveolar nerve canals.

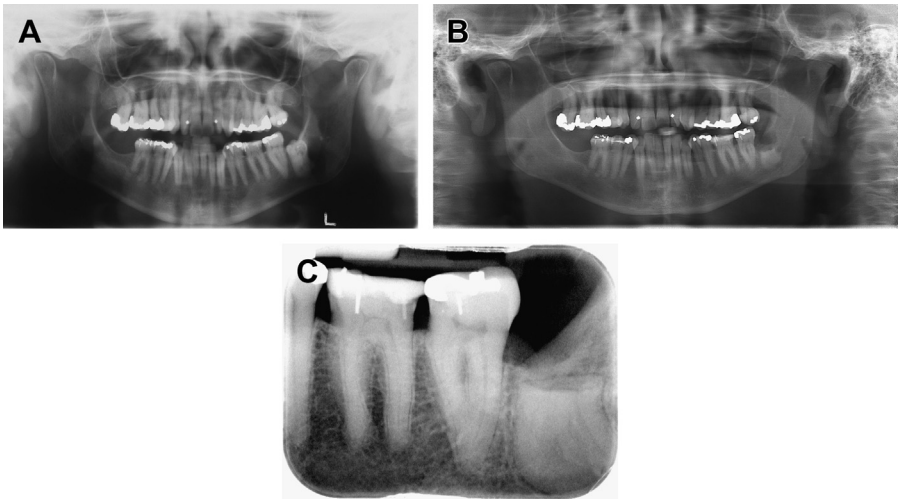

Fig. 6 Patient B.A. is a 69-year-old woman with caries and pericoronitis associated with tooth #17. She was planned for coronectomy. (*A*) Preoperative panoramic radiograph. (*B*) Immediate postoperative panoramic radiograph. (*C*) Periapical radiograph obtained from restorative dentist 7 months postoperatively. The patient refused to return for 6-month postoperative panoramic radiograph, stating "lack of symptoms."

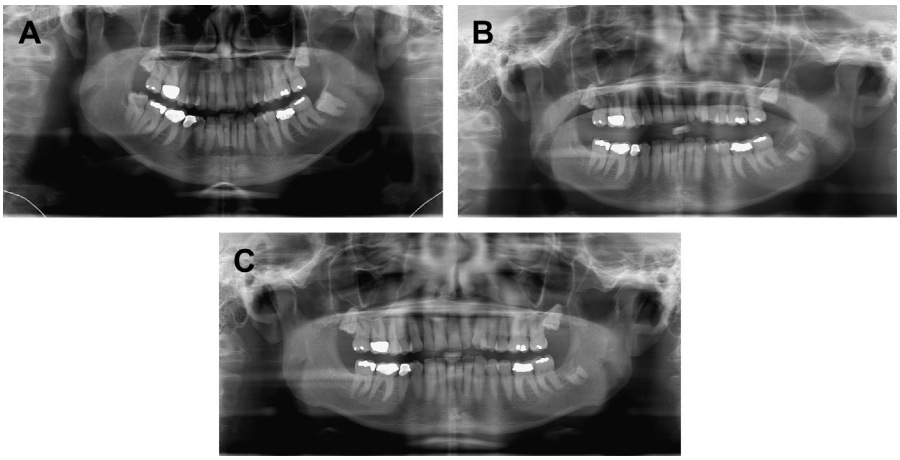

Fig. 7 Patient B.P. is a 58-year-old woman who presented with pericoronitis associated with tooth #17 and caries associated with tooth #32. She was planned for coronectomy on tooth #17 and extraction of tooth #32. (*A*) Preoperative panoramic radiograph. (*B*) Immediate postoperative panoramic radiograph. (*C*) Panoramic radiograph 6 months postoperatively. Note bone regeneration over the residual roots of tooth #17.

Outcomes

There are several studies reported in the literature with 12-month postoperative follow-up data. However, few long-term studies exist. A 3-year follow-up study published in 2012 by Leung and Cheung[14] found no increase in the incidence of infection, pain, development of abnormalities, and root eruption after 12 months. Moreover, 75% of roots stopped migrating 12 to 24 months postoperatively, and there was no migration of roots between 24 and 36 months.

Summary

It is the opinion of the authors that coronectomy is a reasonable and safe treatment alternative for patients who demonstrate elevated risk for IAN injury with the removal of third molars. The procedure has been documented in the oral and maxillofacial surgery literature as a treatment alternative to third-molar extraction in patients considered at elevated risk for permanent nerve injury. Coronectomy is particularly appropriate for patients older than 25 years, and who report low tolerance for the possibility of posttreatment neurosensory deficit at the consultation. The procedure is straightforward, and postoperative recovery is comparable with that of traditional third-molar extraction. Lastly, appropriate patient selection for coronectomy is paramount. Although not typical, patients must have a realistic understanding that additional surgery (eg, removal of residual roots or treatment of infection) may be necessary. Periodic follow-up assessments are required and patient compliance is essential. In brief, coronectomy is a reasonable treatment alternative for appropriately selected patients thought to be at elevated risk for IAN injury associated with extraction of third molars.

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